Background on Guideway Structure Geometry

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The geometric design of fixed guideway system must balance rider comfort, system capacity, and environmental impact. Although these criteria are not mutually exclusive, they do effect the decisions for the design in very different ways.

Rider comfort is usually defined by the motion of the vehicle as it accelerates, brakes, moves around both horizontal and vertical curves. Engineers relate this motion to gravity forces acting upon the rider. All of have experienced rounding a curve in your car or within a bus and having to lean into the curve to balance ourselves. We instinctively shift our weight to compensate for the gravity forces acting upon us.

In fixed guideway design we apply criteria that limits the gravity forces upon the rider to less than 8% of gravity. To apply criteria this to 150 pound rider, the 8% force would be 12 pounds acting upon the rider, who would compensate for this force by shifting his/her balance while seated or holding onto a bar or strap if standing. The same consideration is applied to acceleration and braking.

Some have implied that HHCTCP has applied geometric criteria that favor steel wheel steel rail (SWSR) technology, but this is not the case. HHCTCP criteria are consistent with good engineering practice and can be equally applied to all technologies. Some have claimed that one technology can accelerate more quickly or negotiate tighter curves than SWSR, but this not a real advantage if the goal is to provide comfortable and safe ride for the customer.

System capacity in transit is usually defined as number passengers being transported in one hour and the overall trip time. The geometry of the guideway impacts capacity by dictating the speed of the vehicle. We understand that when driving a vehicle we slow down negotiating a curve. Therefore it is important that the designer does not introduce alignment restrictions that slow down the transit vehicle, delaying its overall runtimes and reducing the number of persons being transported.

The HHCTCP geometric criteria for minimum radius of curve, length of vertical curve and maximum grades were selected to maximize the trip time, but understanding that the route passes through a very dense urban community where curves are necessary. There is no advantage to design for the tightest curve, even though SWSR and other technologies can accommodate this condition. Therefore HHCTCP has decided to design its system to achieve the shortest trip time within the limitations of its urban corridor by applying criteria that meets this goal.

Environmental impact of the project is greatly affected by the geometric criteria of the project. Straight guideways with wide sweeping curves is ideal for ride comfort and shortest trip times, but this is not practical when our goal is to limit private property acquisition and visual impacts to the community. In developing its geometric criteria, HHCTCP had to consider how the guideway would “fit into” the corridor and established criteria that give the designers options in dealing this challenge.

Conclusion: HHCTCP is in very early design, as the designs become more developed with the selected technology the criteria may be modified. However any modification must be measured against these basic criteria of ride comfort, capacity and environmental impact. It is not in the best interest of HHCTCP to limits its potential by over emphasizing one criterion over another, it must take a balanced approach that results best fixed guideway alignment possible.